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HOW TO DIAGNOSE GENIUS: A STUDY OF HUMAN ENERGETICS.

Grosse Männer. By Prof. Wilhelm Ostwald. (Leipzig: Akademische Verlagsgesellschaft, 1909.)

THIS book is a study in comparative biography, and may be said to point the way to a new field of investigation. Prof. Ostwald was prompted to write it, as he tells us in his first sentence, by an ingenuous question put to him by one of his Japanese students as to how budding geniuses could be recognised. Much money, his student went on to say, is spent by various Governments in attempting to discover those people whose thorough education may be expected to bring in a return of value to the State, and the question how best to discover latent genius is an eminently practical one. After cogitation, Prof. Ostwald came to the conclusion that it is those students who cannot be kept on the rails—that is, who are not contented with methodical teaching—who have within them the seeds of genius; and the writer's experience would lead him to the same conclusion.

But in order to lay a basis for such a deduction, vague, to some extent, because derived only from personal impressions, a careful comparison has been made of the lives of six men, all of whom had a great influence on the thought of their time. These are:—Davy and Faraday; Julius Robert Mayer, who shares with Joule the honour of having shown the equivalence of heat and work; Liebig; Gerhardt, who, in his day, contributed to the revolution in chemical thought; and Helmholtz.

These names belong to men of science, exclusively; the reason for the choice is perhaps to be found in words penned by Liebig:—

"The history of the nations teaches us of the futile efforts of powers, political and ecclesiastical, to maintain spiritual and bodily slavery over mankind; future history will deal with the conquest of liberty, gained by the investigation of the reason of things, and of truth; a conquest gained by weapons unstained with blood, and on a field in which religion and morals take part only as feeble allies."

This, it may be remarked, is prophecy, and, as such, is at present beyond criticism; it may, however, be pointed out that to some of us, at least, the prospects held out by the remarkable conquests over what used to be called "the forces of nature" do not at present point to a speedy millennium. However, the retort is open that it is not the spread of the teachings of science, but a disregard for such teachings, which is the reason that our moral progress does not keep pace with our material progress.

Be that as it may, Prof. Ostwald has given, in his masterly style, delightful sketches of the lives of these undoubtedly distinguished men. The biographies differ somewhat from the usual "lives," inasmuch as the failings, as well as the virtues, of the subjects have been touched on. No character is perfect, and, without ample knowledge, it is impossible to attempt to draw just conclusions.

One notable characteristic of men of genius is that

it is rare for them to have come from either a high or a low grade of society. Exceptions are confined practically to England and France, as witness Boyle, Cavendish, and Lavoisier; Faraday might perhaps be instanced as an example—almost the sole example—of the second class.

Another characteristic is the very early age at which such men develop. Goethe was twenty-four years old when he electrified the German nation by his "Sorrows of Werther"; Schiller was twenty-two when he published "The Robbers"; Newton had invented the calculus, discovered the law of gravitation, and had completed his analysis of light before his twenty-fifth year; Linnæus had evolved his sexual system of plants at the age of twenty-four; and the list might be extended indefinitely, to Carnot, Clausius, Scheele, Berzelius, Vesalius, the reformer of the science of anatomy, the physiologists Ludwig, Helmholtz, and Du Bois Reymond, to, last, though not least, Kelvin. Youths who make their mark at a later age, as already remarked, show a distaste for the formal instruction which is still given in the public schools of Germany and England. In this connection it is interesting to note the saying of a writer on English public schools, himself once a distinguished headmaster, that, while a classical or mathematical master does not fall off, indeed improves, with age, inasmuch as he perfects himself in methods of teaching practically unprogressive branches of learning, the science masters cannot but deteriorate, unless they keep abreast with the progress of science by increasing its bounds by their own efforts. Prof. Ostwald takes a strong view of the inutility of the training to be acquired from a linguistic, especially a classical, education, and believes that the usual duration of school life is far too great. In this the writer heartily concurs.

"Had Kelvin or Leibnitz been so unfortunate as to have come into the world in our days, and in Germany, their early development would have been of no avail; they would have sat on the school benches till their eighteenth year—an age at which they had gained a prominent position in science."

The temperaments of the men whose lives are chronicled may be divided under two heads, "Klassiker," or "phlegmatic," to quote an old classification, and "Romantiker," or "sanguine." To the former class belonged Faraday, Mayer, and Helmholtz; to the latter Davy, Liebig, and Gerhardt. These temperaments correspond to the rate of reaction to external stimulus. The romantic type is eager, alert, impatient, and impulsive; the classic type painstaking, conscientious to a fault, self-criticising, and accurate. It is remarked on as curious that most men who have achieved greatness belong to one or other of these classes; it would appear that average minds, who occupy a mean position, being neither very impulsive nor very critical, have not the qualities which raise them above their fellows.

The "yield" of such minds, to use an expression borrowed from chemical manufacture, depends, according to Ostwald, on their "economic coefficient." To transform one kind of energy into another implies the "degradation" of a portion; this is the second

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law of thermodynamics. Born into the world with the usual amount of energy, *i.e.* capacity for work, some minds are so constituted as to transform a large portion of it so that it is of service to humanity, while a comparatively small portion is, as it were, wasted. The sum of the action of such minds constitutes human progress. It is necessary that the progress of the individual genius should be hindered as little as possible by artificial and unnecessary obstacles, and it would appear that in some countries the path is made easier than in others. Taking the membership of national academies as a test, if only a rough one, of scientific eminence, the proportion of distinguished men to the inhabitants, reckoned in millions, is in Saxony 0.2, in Baden and Norway 0.25, in Switzerland 0.33, in Holland and Bavaria 0.41, in England and Prussia 0.49, in France 0.79, in Italy 2.17, in Austria 2.7, in the United States 3.08, and in Russia 16.3; that is, for example, there is in Russia only one member of international academies to 16.3 million inhabitants. It can hardly be doubted that this low number is due to the hindrances which stand in the way of the progress of youths who might, in Russia, display genius, and enrich the world by their efforts.

It is impossible to review such a book as this satisfactorily in a short article. It teems with interest, not only on account of the intrinsic attractiveness of the subject, but also because of the masterly grasp of it displayed by the author. Whatever Prof. Ostwald writes is sure to interest, owing to the originality of his mind and his lucid and attractive method of presentment. On every page there occurs some saying which excites attention, even although the reader may sometimes be disposed to challenge the conclusions drawn. The questions discussed are well worth the most careful consideration of all who have the welfare of humanity at heart. The problem considered is an eminently practical one—perhaps the most practical problem which exists—and we owe the author a debt of gratitude for having introduced it to us in such a charming manner.

W. R.

SOME MEN AND MATTERS IN CHEMISTRY.

Essays, Biographical and Chemical. By Sir William Ramsay, K.C.B., F.R.S. Pp. vii+247. (London: Constable and Co., Ltd., 1908.) Price 7s. 6d. net.

IT is good to read about the pioneers of science, their trials and their triumphs. Even it is good for the student who has to "grind" up facts about scientific worthies and serve them up hot to a voracious examiner; albeit in such a case it smacks strongly of "turning old heroes into unworthy potions," as Sir Thomas Browne remarks in discussing the medicinal virtues of mummies. At any rate, such a student would get some of the facts about his heroes pleasantly enough in reading what Sir William Ramsay has to say in the present volume concerning Boyle and Cavendish, Davy and Graham, Black, Kelvin, and Berthelot.

The essays are a collection of lectures and magazine articles published, the author tells us, at various times during the last twenty-five years. It follows that they are of a popular character in the sense that little or

no special knowledge on the part of the reader is assumed. They are somewhat unequal in scope and treatment, as may be inferred from the fact that the organs in which they first appeared included such diverse publications as the *Youth's Companion* and the *Proceedings of the Royal Society*.

Of the biographical essays, those upon Berthelot and Lord Kelvin seem to the present writer to show the author at his happiest. Perhaps that is because there is the personal note in them; for Sir William Ramsay was acquainted with the French *savant* as well as the English one. He gives us an attractive glimpse of the happy home life of the Berthelots. There was a touch of romance, too, about the meeting of young Marcellin Berthelot with his future wife, which is described in the essay, and which we may venture to quote almost in the author's words. Made-moiselle Breguet was beautiful and well-dowered, but presumably beyond Berthelot's reach. However, one day she was crossing the Pont Neuf in the face of a strong wind, wearing a charming Tuscan hat.

"Behind her walked her future husband; suddenly she turned round to avoid having her hat blown off, and practically ran into his arms. A case of love at first touch," says Sir William.

The stories of Boyle and of Cavendish will always appeal to chemists. The author describes and contrasts the work and character of the two men in an interesting little sketch. "Each was in advance of his age"; Boyle by reason of his calm philosophical spirit and clear judgment, Cavendish in his power of refined quantitative experiments and deductions. Neither was married; and the author, after reflecting that Boyle was too many-sided and Cavendish too reserved, remarks:—"It is perhaps legitimate to draw the conclusion that man's nature does not culminate in its best without the influence of a helpmeet." It may be so; but another conclusion, perhaps equally legitimate, is that if there had been a Mrs. Boyle and a Mrs. Cavendish there might have been no "Sceptical Chymist" and no "Experiments on Air." Black also, it may be noted, remained unmarried, though a particular favourite of the ladies. Perhaps they missed much, these three distinguished chemists, both in personal happiness and in perfection of character; but it may well be that their loss was mankind's gain, and that chemical science has cause to bless the circumstances which enabled them to pursue their researches with singleness of aim, undistracted by either the joys or the troubles of matrimony.

A sketch of the careers of Davy and Graham completes the essay on the "Great London Chemists." Space allows only a brief mention of the author's comparison of the four. Graham, with his philosophical mind, more resembled Boyle than Cavendish or Davy. While Cavendish carried his devotion to science so far that it deprived him of the ordinary pleasures of a human being, and while Davy, in relation to fashion, could not escape the accusation of playing to the gallery, Graham pursued a happy mean, beloved by his friends, esteemed by all. "Of him, as of Faraday, it might have been said with no shade of misgiving, 'He was a good and a true man.'"